

2015 Annual Report on Puget Sound Water Quality in Mason County

Prepared by:

Squaxin Island Tribe- Erica Marbet

Mason County Public Health- Katie Otanez, Stephanie Kenny, Cindy Waite

With contributions from:

Mason County Conservation District- Katrinka Hibler

WSU Extension- Erica Bates

Executive Summary.....	2
Mason County Water Data	4
General.....	4
Ambient.....	5
Oakland Bay	8
Investigations of shoreline and upland sites with elevated fecal coliform	16
Chapman Cove	21
McLane Cove.....	26
North Bay	28
Squaxin Island Tribe Water Data	30
Mason County On-Site Septic Program	36
Washington State University Extension Activities	40
Mason Conservation District Activities	41
References	43
Appendix I. Quality Control Data of Mason County.....	44
Appendix II. Ambient Data collected by Mason County	45
Appendix III. Quality Control of Squaxin Island Tribe Fecal Coliform Sampling	46

Executive Summary

This is a summary of calendar year 2015 activities of the Mason County Pollution Inventory and Correction (PIC) program. Washington State Department of Health (Shellfish Program) marine water quality sampling stations continue to show high levels of fecal coliform bacteria at certain sampling stations in the Oakland Bay and North Bay Growing Areas, and this has resulted in a continuation of closures for portions of both bays. Mason County Public Health (MCPH) responded by doing intensive sampling in these areas, along with outreach to residents, on-site septic system management and stormwater management. Where animal waste from farms was present, the Mason Conservation District (MCD) worked with landowners to implement best management practices. Thirteen farm waste management and fencing projects were slated for 2015, but only three were completed with funding from the current grant. This occurred because the landowners chose not to implement 35-ft buffers on agricultural ditches. MCD identified other funding to help landowners complete as many other BMP's as possible. Washington State University Extension (WSU) completed outreach to local residents in the form of workshops, booths at fairs, and mailed water quality updates to residents. The Squaxin Island Tribe (SIT) continues monthly sampling at the mouths of eighteen creeks that drain into Puget Sound. Washington Department of Ecology (ECY) remains available for enforcement. All of these efforts will be described in detail below.

The basic program of septic system inventory, water quality monitoring, landowner outreach, and enforcement that Mason County Public Health has assembled is efficient, but understaffed, and permanent funding for the program is unknown. The health of Mason County waters is dependent upon the continuation of this program. The program's strengths and efficiencies are in encouraging septic system maintenance, tracking all septic systems in the county, education, keeping a baseline of water quality data, and addressing the problems that stand out, i.e. septic system failures and properties with animals adjacent to waterbodies. It is important to the Squaxin Island Tribe and shellfish growers that the County focus additional resources on follow-up at sites where fecal coliform bacterial counts exceed the freshwater standard (Table 1), on sites with season high bacterial counts, and on sites where the pollution source is hard to pin down spatially. This means much more interaction with landowners. The importance of follow-up on these "hard to pin down" sites comes from the fact that their receiving waters are extremely valuable fish and shellfish habitat of South Puget Sound. Furthermore, these receiving waters are very sensitive to increased burden of bacterial waste, and closure of shellfish beds due to bacterial pollution is increasing, not decreasing, at this time in the county. There is no current indication that Mason County will provide permanent funding to maintain the clean water programs listed above.

Positives:

Septic Blitz (pg. 36)

Manure Exchange Program (pg. 41)

**Water Quality and Septic System Datasets
(pg. 5 and 36)**

Ongoing education (pg. 40)

Negatives:

**Norovirus on South shore of Hammersley
Shellfish Closures at:**

Oakland Bay

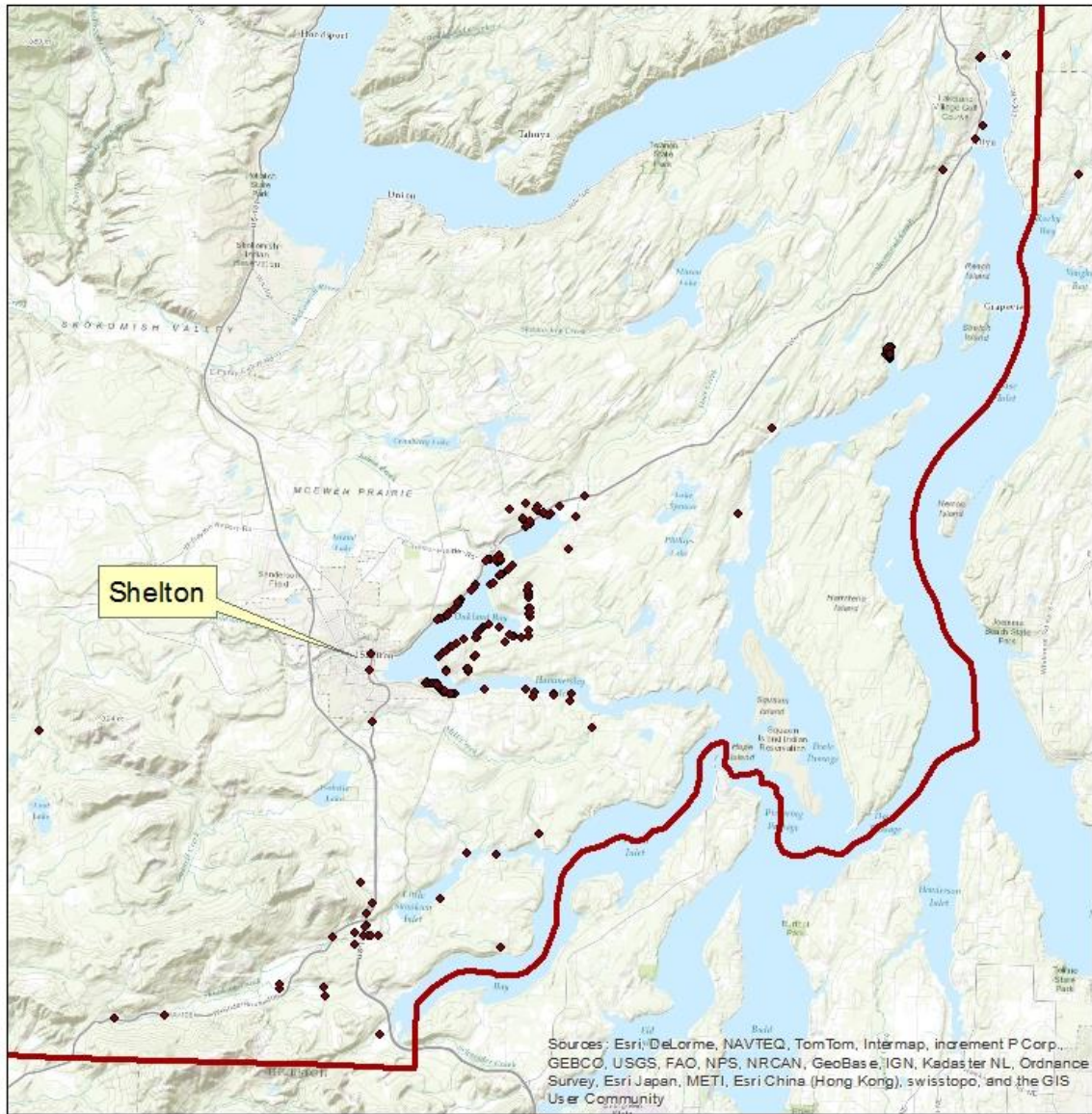
Chapman Cove

North Bay

Mclane Cove

Church Point

Lack of future funding for this program.



Legend

- Mason County Line
- ◆ All 2015 Monitoring Events

0 1 2 4 Miles



**Squaxin Island Tribe and Mason County
Water Quality Monitoring Stations 2015**

Figure 1. 2015 monitoring locations of Mason County Public Health and the Squaxin Island Tribe.

Mason County Water Data

General

The water quality goal established in the QAPP is the state marine water quality standard. This standard is normally applied to the mouths of tributaries. The comparable fresh water standard is WAC 173-201a-200(2)(b). This standard should be applied to samples not influenced by marine waters. The standard applied to Oakland Bay shoreline sampling is a modification of Mason County Water Quality Standard Operating Procedures adopted in the Oakland Bay Marine Recovery Area QAPP.

Table 1. Water Quality Standards for Fecal Coliform (FC) referenced in this grant.

Marine Standard <i>Source- QAPP and WAC173-201a-210 (2)(b)</i>	Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, and not have more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies /100 mL.
Fresh Water Standard <i>Source-WAC173-201a-200 (2)(b)</i>	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies/100 mL.
Oakland Bay Shoreline Standard <i>Source- Oakland Bay Marine Recovery Area QAPP</i>	Discharges with values greater than or equal to 200 FC/100mL will be considered high priority for FC confirmation sampling. Discharges with values greater than 100 FC/100mL will be considered medium priority.

The fresh water rather than marine water quality standard has been chosen as the standard to apply in reviewing the data. Roughly a quarter of the Mason County ambient sites are under marine influence at high tide, but since the samples are taken flowing off the land during a lower tidal stage, the fresh water standard seemed most applicable. The areas in the grant where the marine sampling standard could be applied are some of the ambient sites, and some of the Chapman Cove sites.

The shoreline samples are also taken flowing off land. They are tested for salinity in cases such as beach seeps when it is not clear whether the water originates on land and diffuses down through layers of the beach to surface again lower on the beach, or whether the origin is marine water draining out of the top layer of gravel, mud or sand.

In 2015, 507 samples were collected. The data tables in the Mason County sections highlight all results over the fresh water standard in red font. Rain events are denoted with yellow fill. The GMV noted in the tables is the geometric mean value.

Ambient

The goal of long term ambient monitoring is to track changes in water quality over a long period of time due to changes of use and development in the area. The sites selected as part of this grant were chosen because they were not part of the Squaxin ambient sampling, and because each is a significant drainage in a sensitive area or has/had some development in the area. Sites were sampled monthly.



Figure 2. Ambient Sampling Sites

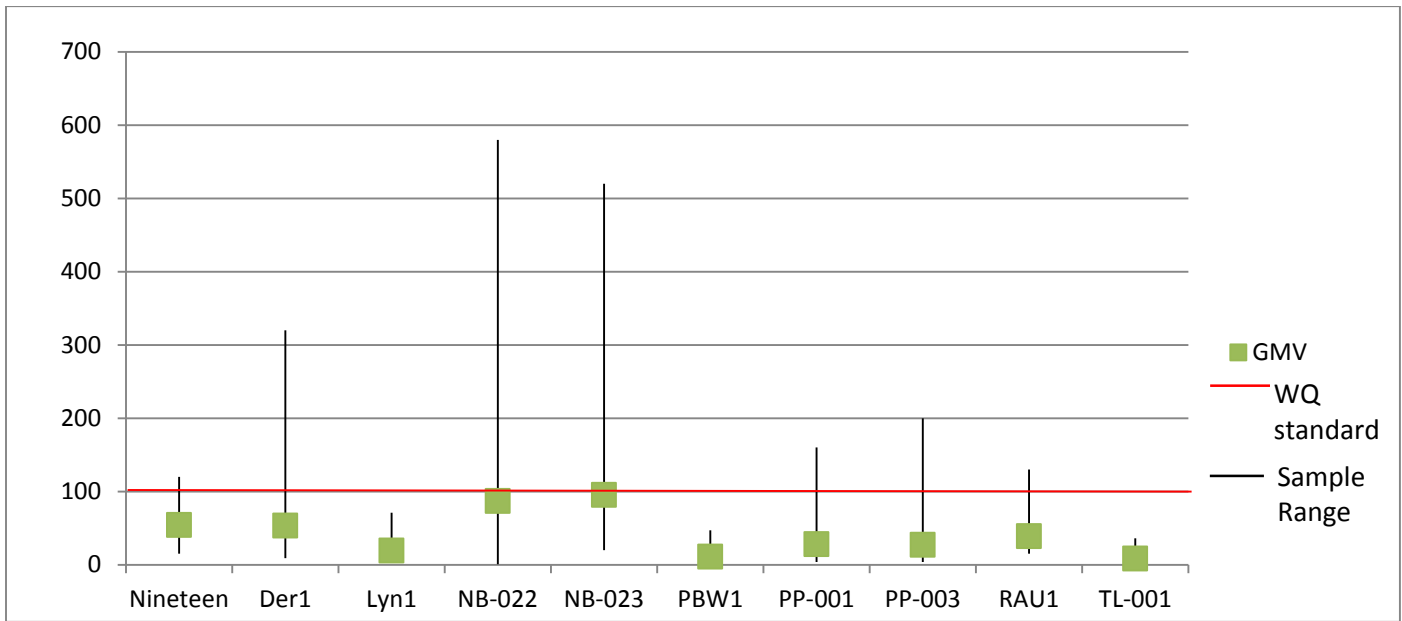
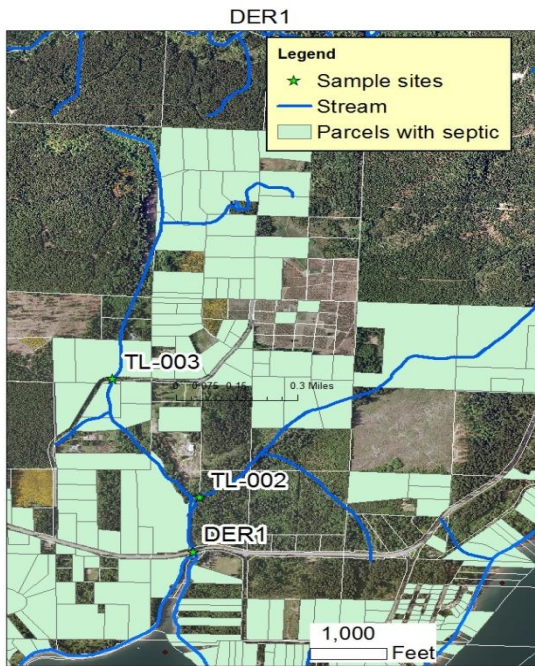


Figure 3. Ambient Results. Fecal coliform bacteria range and geometric mean (# of colonies per 100 mL)

Discussion- All sites met the first part of the fresh water standard with geometric means below 100 FC/ 100 mL water (Figure 3). DER 1, NB-022 and NB-023 exceeded the second part of the fresh water standard. DER1 flows from a lightly developed area, though potential farms were found in the drainage none appears actively engaged in livestock farming (Figure 4B). Dry season flow starts considerable down from the headwaters. Individual results may be found in Appendix 1. NB-022 and NB-023 have development at the headwaters (Figure 4A). Dry season flow starts considerably down from the headwaters. Individual results may be found in Appendix 1.



A



B

Figure 4. Ambient Development

Oakland Bay

Oakland Bay Shoreline

The goal of the shoreline sampling plan is to survey one third of the Oakland Bay Clean Water District shoreline every year and to sample all the culverts, bulkhead drains, natural drainages and rapidly flowing seeps in the survey area. Each site is sampled twice: once in wet weather and once in dry weather. The middle section, which is divided into OBC and BOB sites on the west side and OBY sites on the east side of the bay, was sampled in 2015 (Figure 5). The sites with high results were surveyed for water quality problems and issues addressed either through education or dye traces, if necessary (Table 2). For sites with elevated results later in the year, there may not have been sufficient time for follow-up, these sites would have received follow up in 2016 had funding continued.

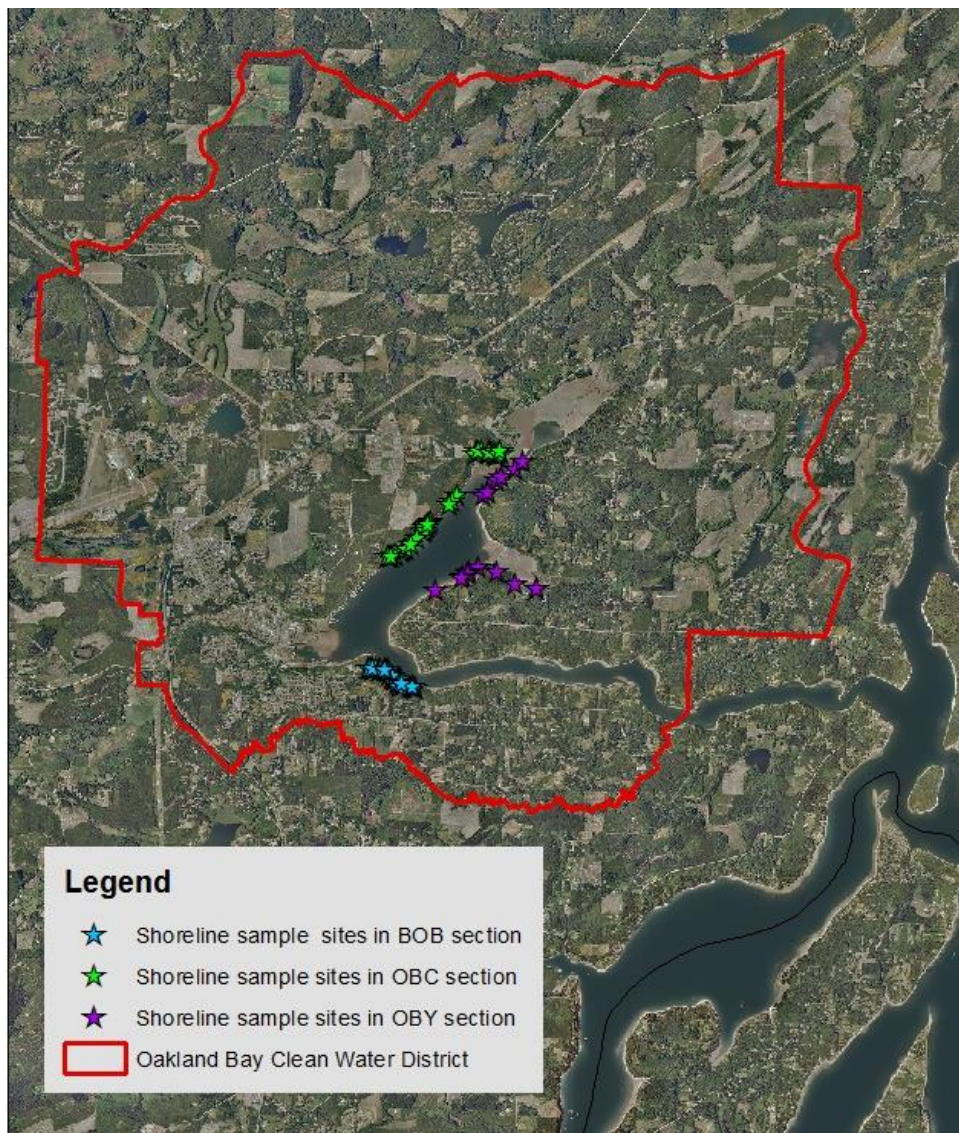
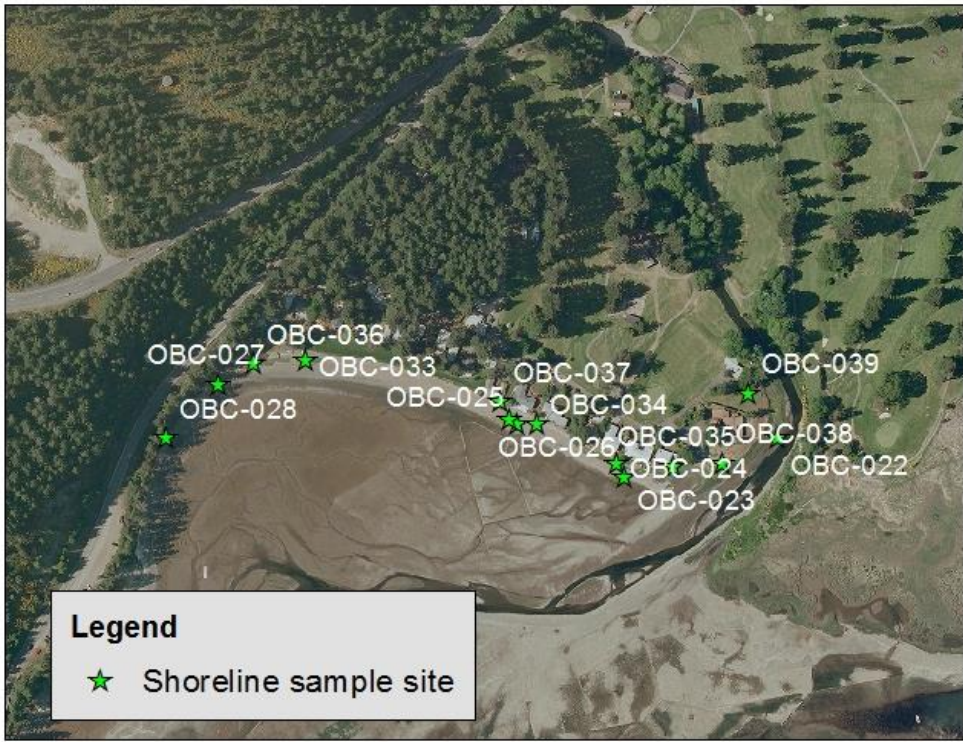


Figure 5. 2015 shoreline sample sites



A



B

Figure 6. OBC section of Oakland Bay shoreline

Discussion of water quality in the OBC section of shoreline

OBC-062 and OBC-068 was the only shoreline OBC site that needs additional work. The elevated result happened later in the year so there was no time to resampling. If future funding allows, the OBC-068 should be samples again to establish whether it is a hot spot that should be investigated or not. OBC-062 could be investigated. There were sample events (Table 2, highlighted in yellow) were it rained heavily on the day the samples were collected. These samples were included in the data because shellfish harvest in the area is not rain dependant.



Figure 7. OBX section sample sites

Table 3. OBY sample results. Fecal coliform bacteria (# of colonies per 100 ml)

Precip. (inches)	0	0	0	0	0	0	0	0	1.5-2.0	Geometric Mean (excluding rain events)
Site	3/4/2015	3/9/2015	6/1/2015	6/16/2015	8/26/2015	9/22/2015	10/5/2015	11/18/2015		
OBY-031				200						200
OBY-033			210		3					25
OBY-036			110	180	210					161
OBY-039			160	9.5	1					11
OBY-045						36		13		36
OBY-054						180				180
OBY-057						92				92
OBY-060		5				800				63
OBY-061		1				1				1
OBY-062		1				7				3
OBY-063		1								1
OBY-064	1	1								1
OBY-073				2	1					1
OBY-080			230	79						135
OBY-081				9	410					61
OBY-082			22.5	35						28
OBY-088								28		0
OBY-109							3			3

Discussion of water quality in the OBY section of shoreline

Three sites had elevated counts. OBY-036 was investigated and found to drain from an undeveloped area so its source is wildlife. OBY-080 was investigated, site OBY-035 is also part of property included in the investigation. It is a vacation property. If additional grant funding allows, the owner has agreed to a dye trace of the OBY 80/35 property while they are there in summer of 2016 (see Table 7). OBY-054 has about 500 feet of riparian buffer between it and upstream development so its source is likely wildlife. One sample event (Table 3, highlighted in yellow) was not included in geometric mean calculations because it rained heavily on the day the samples were collected so results may have been higher than under shellfish harvest conditions.



Figure 8. BOB section sample sites

Table 4. BOB sample results. Fecal coliform bacteria (# of colonies per 100 ml)

Precip. (inches)	0	0	0	0	0.1	0.1	0.1	0.75	2	Geometric Mean (Excluding Rain Events)
Site	6/17/2015	6/29/2015	6/30/2015	9/14/2015	10/6/2015	11/9/2015	11/19/2015	12/7/2015	12/8/2015	
BOB-020			1							1
BOB-022			370	4			11			25
BOB-023			140	4			19			22
BOB-025							1			1
BOB-026							6			6
BOB-027							11			11
BOB-029									140	140
BOB-031									40	40
BOB-033									10	10
BOB-034		1							11	3
BOB-035		1						4		2
BOB-036		48						100		69
BOB-037		84						120		100
BOB-038								840		840
BOB-047	120			1	370	31				34
BOB-048					2	4				3

Table 4 **continued**

Precip. (inches)	0	0	0	0	0.1	0.1	0.1	0.75	2	Geometric Mean
Site	6/17/2015	6/29/2015	6/30/2015	9/14/2015	10/6/2015	11/9/2015	11/19/2015	12/7/2015	12/8/2015	
BOB-049	7									7
BOB-050	46				280	44				83
BOB-051						6				6
BOB-052	12					13				12
BOB-053	11						5			7
BOB-054							18			18
BOB-055					1		1			1
BOB-056		87			150		550			193
BOB-058		79			190		88			110
BOB-059					2			1		1
BOB-060					3			2		2
BOB-061					22			1		5
BOB-062		5			22			1		5
BOB-063		1			1			1		1
BOB-068						3				3
BOB-075					1			1		1
BOB-076		1						28.5		5
BOB-080							36			36
BOB-081							1			1
BOB-082		11					31		250	44
BOB-084							1			1
BOB-085									230	230
BOB-087						1				1
BOB-153									150	150
BOB-154	1						1			1
BOB-155						1				1
BOB-168	1					1				1
BOB-169	10					1				3

Discussion of water quality in the BOB section of shoreline

Bob-056 and Bob-058 are sites with confirmed high counts during non-rain events. They should be investigated if funding allows in 2016. Sites Bob-153, 085 have incomplete data. They were sampled during a rain event. The BOB section is closed to shellfish harvest at all times so it is up to the investigator whether or not to follow up on Bob-153 and 085.

Investigations of shoreline and upland sites with elevated fecal coliform

In the final year of the grant work 17 shoreline sample sites, six farms and one stream were investigated. Seventeen other shoreline sites received follow up sampling and were determined not to need investigation/dye tracing. The shoreline investigations resulted in three dye tests (one dye positive).

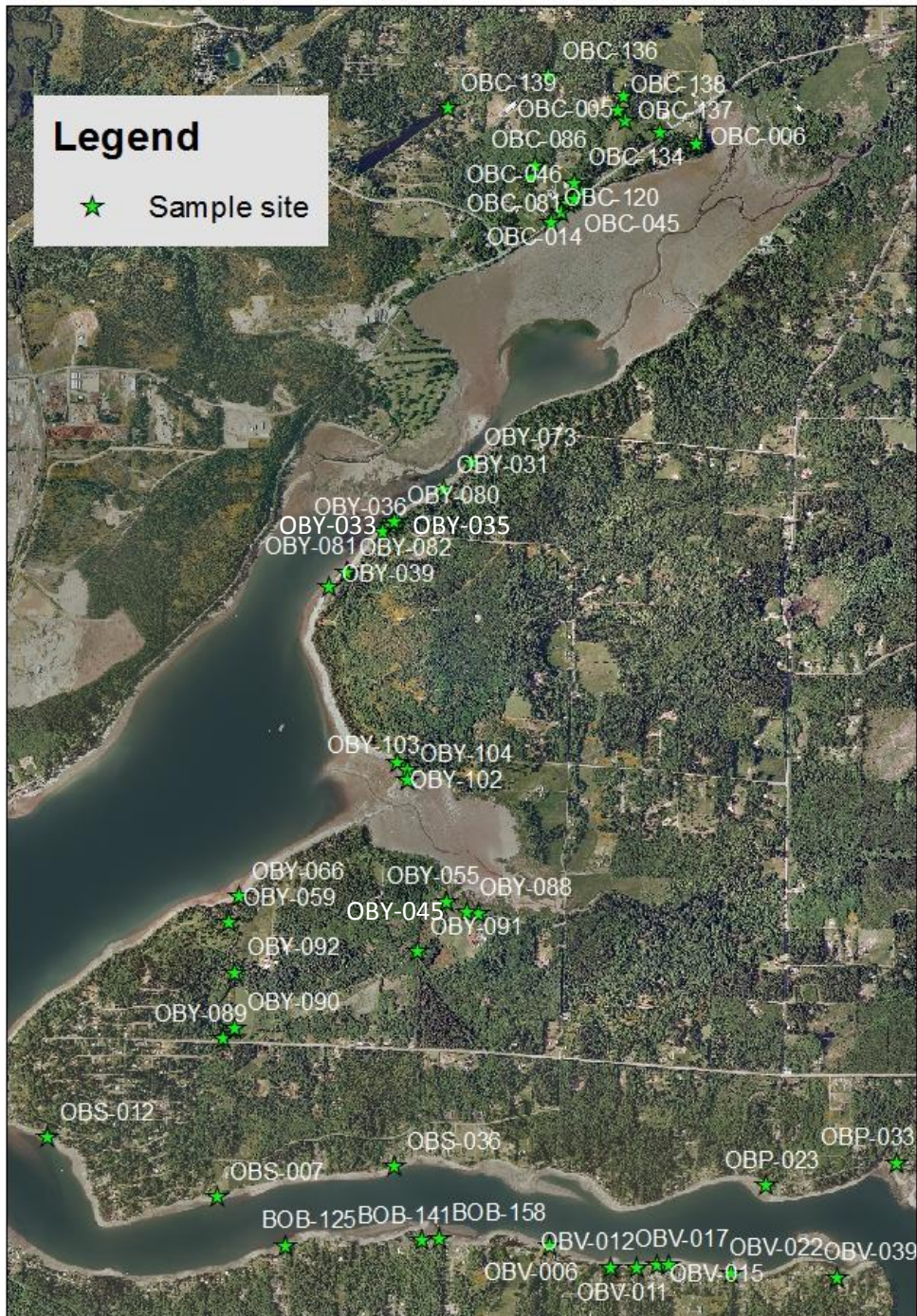


Figure 9. 2015 investigation sites and confirmation sampling sites

Table 5. 2015 Resolved shoreline confirmation sampling

site	resolution
OBY-031	Further investigation not needed due to low Geometric Mean
OBY-033	Further investigation not needed due to low Geometric Mean
OBY-035	Owner agreed to dye trace summer 2016
OBY-036	Investigated. From natural area.
OBY-039	Further investigation not needed due to low Geometric Mean
OBY-045	farm, put in contact with CD
OBY-055	Further investigation not needed due to low Geometric Mean
OBY-059	farm, put in contact with CD
OBY-073	Further investigation not needed due to low Geometric Mean
OBY-080	Same property as OBY-035. Owner agreed to dye trace summer 2016
OBY-081	Further investigation not needed due to low Geometric Mean
OBY-082	Further investigation not needed due to low Geometric Mean
OBY-089	Further investigation not needed due to low Geometric Mean
OBY-092	Further investigation not needed due to low Geometric Mean
OBY-102	investigated, natural sources only
OBY-103	investigated, natural sources only
OBY-104	investigated, natural sources only

Table 6. Resolved Hot Spot Investigation

Site	Resolution
BOB-125	wildlife is most likely source
BOB-141	9/2/15 GMV 50.1 halt investigation.
BOB-158	9/2/15 passed dye test
OBP-033	passed dye test
OBS-012 (& 046)	Results low. Halt investigation.
OBV-006	9/2/15 GMV 47, halt investigation
OBV-011	Septic unlikely source. Pet waste more likely. 11/20/15 sent letter educating them about pet waste.
OBV-012	9/2/15 GMV 38 halt investigation
OBV-017	11/5/15 Summer weekend home only. Two of 3 elevated counts taken some time other than summer so septic unlikely source.
OBV-022	9/2/15 GMV 8, halt investigation
OBV-039	9/2/15 GMV 3 halt investigation
OBY-036	Investigation determined it is likely natural sources.

Table 7. Unresolved Hot Spot Investigations

Site	Resolution
OBP-023	One system passed dye test. Other homeowner willing to dye test in 2016.
OBY-035 (OBY80)	Willing to dye trace in the summer 2016 when they are using the system.
OBS-036	Investigated and dye tested on the basis of a single elevated sample result (120 FC). Dye negative. Site should be resampled to determine if more investigation should be done.
OBV-015	Dye test refused by both properties of interest. Tribe requests follow up.
OBS-007	Site dye positive. New conveyance from neighboring property found when allowed on dye test property. Should sample and assess for dye test in 2016.

Discussion of confirmation and investigation sites

The majority of the elevated shoreline sampling results have been resolved. Two sites need an additional dye trace and two sites need additional investigation to determine what is needed. One site cannot be resolved because both property owners have refused a dye test. The Squaxin Island Tribe requests a follow up communication with those landowners

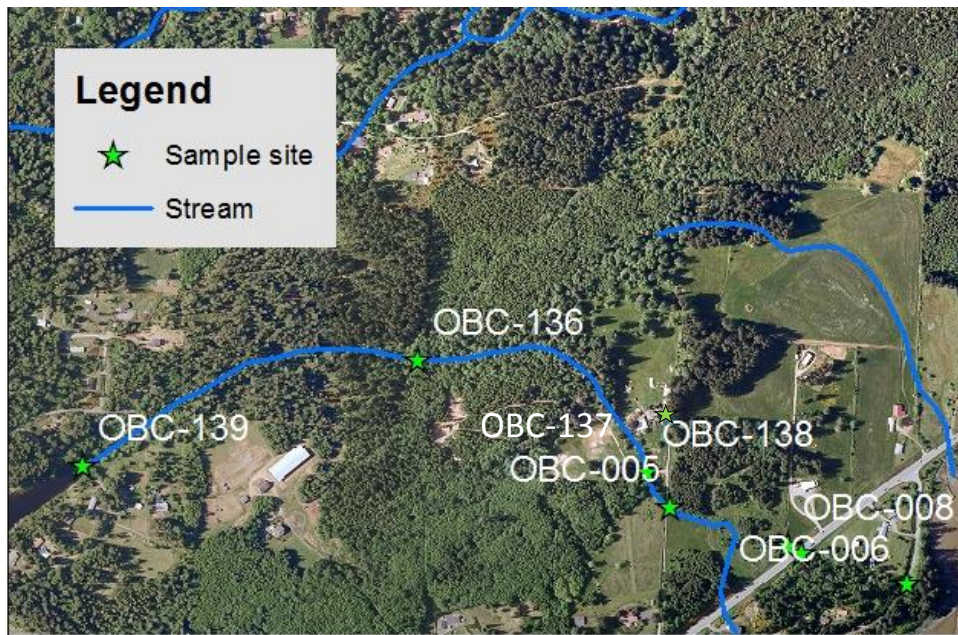


Figure 10. Ecler Creek Investigation

Table 8. Ecler Creek sample results. Fecal coliform bacteria (# of colonies per 100 ml)

Precip. (inches)	0.01-0.10	0	0.25-0.50	0	1.0-2.0	0	0	0.01-0.10	Geometric Mean (excluding rain events)
Site	3/11/2015	5/21/2015	8/31/2015	10/7/2015	11/17/2015	11/23/2015	11/30/2015	12/1/2015	
OBC-139					84	5	1	1	2
OBC-136					120	14			14
OBC-005	19		530	800				63	150
OBC-138					180			19	19
OBC-004 or 008				895	165	220	20	13	97
OBC-006	11	65.5							27
OBC-137					1600				NA

Discussion of Ecler Creek water quality

Ecler creek showed a location with elevated fecal coliform at OBC-005, elevated counts at OBC-004/8 are likely influence by OBC-005 since they are directly downstream and the area between is undeveloped. It is an area of a farm. The farmer works with Mason Conservation District. He has now fenced animals away from that area in response to the high counts. We investigate back to the source waters at Catfish Lake to address concern that pollution could be from that area. We found relatively low counts at the lake and also discovered that the lake is no longer hydraulically connected to Oakland Bay for most if not all of the year. The flow path has been cut off by a logging road in the upper watershed. A local resident tells us that water makes it over the road late in the winter; this was not observed during our sampling events.

Ecler Creek flows to the Squaxin Island Tribe’s sampling site TR24 (Figure 17,

Table 13), which has failed the freshwater quality standard (at the 90th percentile) almost every one of the past 13 years.

North End of Oakland Bay- Farm Investigations

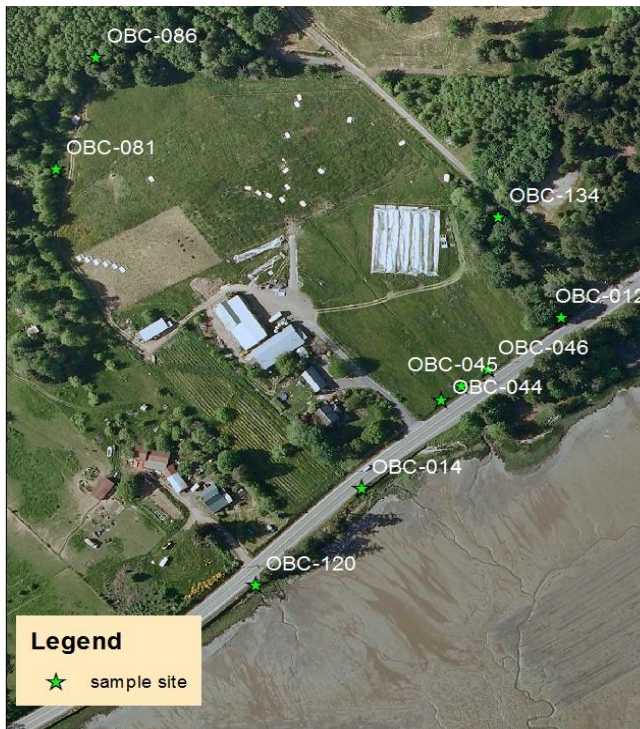


Figure 11. North end farm investigations

Table 9. North end farm sample results. Fecal coliform bacteria (# of colonies per 100 ml)

Precip. (inches)	0	0.25-0.50	0	0.75-1.5	1.0-2.0	1.5-2.0	0.01-0.10	Geometric Mean
Site	6/15/2015	8/31/2015	10/7/2015	11/2/2015	11/17/2015	11/18/2015	12/1/2015	
OBC-012						102.5		102.5
OBC-014			800			87		264
OBC-044			800			600		693
OBC-045						45		45
OBC-046						82		82
OBC-081		370				52		139
OBC-086			840					840
OBC-120		260						260
OBC-134							220	220

Discussion of water quality at north end farms

Towards the north end of Oakland Bay is a cluster of four farms. Three of the farms are working with the CD on farm planning and the other one has expressed willingness to participate in farm planning.

- One farm does not have drainage to streams from the livestock area. OBC-086 drains a spring and wetland area separated from livestock by a large forested buffer. Wildlife is the source of elevated counts in that area. They have expressed willingness to work with the CD.
- OBC-120 is the drainage of a farm with a mixture of animals. They are working with the CD.
- OBC-134 is a drainage from another farm's south fields. The north field's drainage is part of the Ecler creek investigation. Concentration of animals on this farm appears heavy at times. They are working with the CD.
- All other samples come from the final farm in the area. They are working with the CD.

Chapman Cove

Chapman Cove was a separate task amended to the grant in 2012. Sampling started in October 2012 and continued through to the end of the grant in a modified form in 2015. As a result of the sampling from 2013, the Mason Conservation District is working with two of the farms in the area to create farm plans.



Figure 12. Chapman Cove farms

Table 10. Chapman Cove farm sample results. Fecal coliform bacteria (# of colonies per 100 ml)

Precip. (inches)	0	0	0.25-0.50	0.01-0.10	0	0	1.5-2.0	Geometric Mean (Excluding Rain Events)
Site	3/9/2015	6/30/2015	8/31/2015	9/8/2015	9/22/2015	10/7/2015	11/18/2015	
OBY-045					36		13	36
OBY-055 or 0056			220	800	800	800	260	579
OBY-059		150				540	49	285
OBY-066	10.5	140			120	1400		125
OBY-088							28	
OBY-089							53	
OBY-090							100	
OBY-091			440				280	440
OBY-092							35	

Discussion of water quality at Chapman farms

Two farms in this area are working on improving their water quality. The farms were referred to the Conservation District in previous years. Sampling this year was to check if the corrections were effective or not.

- Sample points for one farm were OBY-092, 091, 090, 088, 056, 055 & 045. OBY-055 and OBY-056 were sampled a number of times at base flow conditions. Flow from the upper fields where animal were pastured were not apparent during the summer high counts downstream at 055 and 56. Water quality actually improved 11/18 when the stream was flowing from OBY-091 in the upper field to OBY-055/56 though it did not meet water quality standards during any sample event.
- Sample points for the other farm were 089, 029, 059 & 066. OBY-066 continued to have elevated fecal coliform levels. The upper area of the farm were only sampled one, the farmer says that he is not ready for post correction sampling yet.



Figure 13. Chapman Cove sample sites

Table 11. Chapman Cove results. Fecal coliform bacteria (# colony forming units per 100 mL water).

Precip. Inches	0	0.01-0.10	0	0	0	0.10-0.25	Geometric Mean (Excluding Rain Events)
Site	2/17/2015	4/1/2015	5/27/2015	7/21/2015	8/24/2015	10/27/2015	
UJC-017	20	78	110	63	640	220	107
UJC-023	33	32	100	200	44	110	68
UJC-024	23	32	88	55	31	140	50
UJC-025	3	8	35	36	21	43	39
UJC-026	120	17.5				28	39
UJC-033	23.5	59	150	250	390	160	122
UJC-039		250					250
UJC-040		11					11
UJC-042					290	170	222
UJC-043	21	51	230	275	440	240	139
UJC-045	14	170	410	220		1200	192
UJC-047			47				47
UJC-055			160				160
UJC-056		7					7

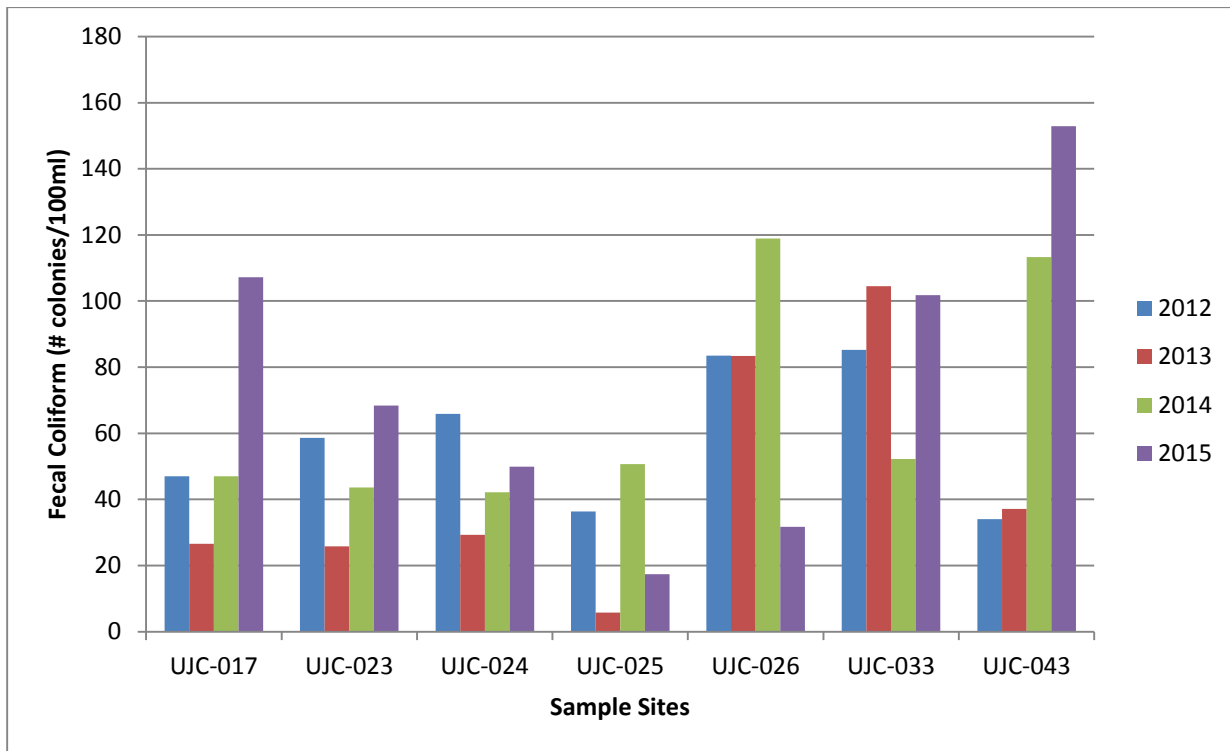


Figure 14. Comparison of annual geometric means for select Uncle John Creek sample sites 2012-2015

Discussion of Chapman Cove Water Quality

Uncle John Creek failed to meet the freshwater standards for geometric mean this year (Table 11). Since 2012 it has met the standard for geometric mean and only one failed the second part of the standard (not more than 10 percent of all samples exceeding 200 colonies/100 mL). The higher fecal coliform level may be due to the long, dry summer causing more sampling to be under base flow conditions. The results may also be due to random variation. The stream was sampled fewer times than in previous years (6 versus 10) so accuracy of the geometric mean was decreased. It may also be due to increased fecal coliform entering the stream. The increase in coliform between UJC-023 and UJC-017 (directly downstream) is especially noteworthy. The properties between those two sample sites should be reassessed for potential sources of coliform (**Error! Reference source not found.**). Septic systems, farms and pets are potential sources in that area. UJC- 043 was investigated and found to be from an undeveloped area during base flow, but there is a pit privy in that area. The property with a pit privy should be investigated. The developed properties above UJC-045 should be investigated as well. UJC-033 results have fluctuated less over time. The sample site is on a bend in the stream so sediment deposition may play a role in the elevated counts.

McLane Cove

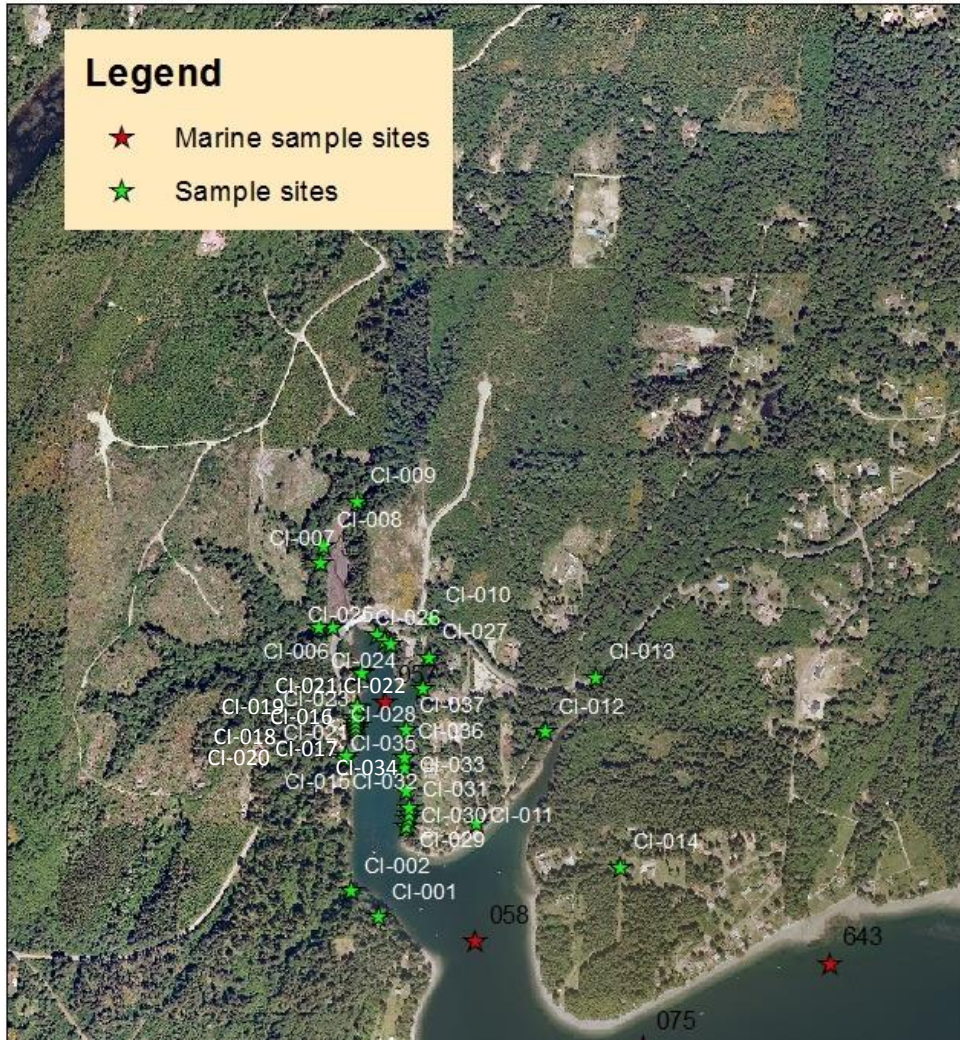


Figure 15. McLane Cove sample sites

Table 12. McLane Cove sample results. Fecal coliform bacteria (# of colonies per 100 ml)

precip.	0	0	0
site	7/28/2015	8/10/2015	8/25/2015
CI-015	1		
CI-016	1		
CI-017	1		
CI-018	1		
CI-019	25		
CI-020	350		
CI-021	13		
CI-022	7		
CI-023	35		
CI-024		140	
CI-025		6	
CI-026		1	
CI-027		1	
CI-028		65	
CI-029			2
CI-030			76
CI-031			8
CI-032			10
CI-033			40
CI-034			19
CI-035			69
CI-036			1
CI-037			120

Discussion of McLane Cove Water Quality

Marine Station 57 (shown in red) in the inner McLane Cove area was downgraded by the State Department of Health to conditionally approved in fall 2015. The shoreline of McLane Cove was sampled once in preparation for the shellfish protection district activities that will take place due to the downgrade. The shoreline sites found are seeps or bulkhead drains for the most part. In spite of the dry summer the area was fairly wet so these small flows probably make a significant contribution to the fresh water in the cove. The shoreline contributions should be assessed as part of the shellfish protection district work.

North Bay

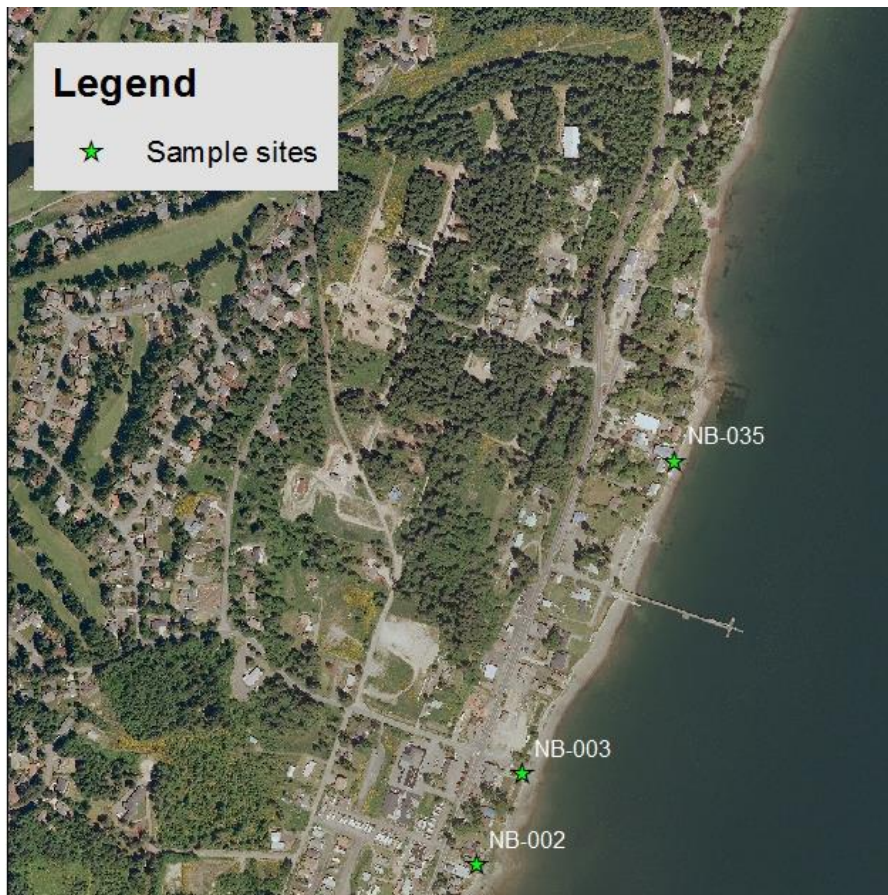


Figure 16. North Bay sample sites

Sampling, follow up, education and correction in the North Bay area took place earlier in the grant. In 2015 three sites received additional follow up. NB-035 had previously had elevated fecal coliform. It was resampled and followed up on with property owner. It drains from a roof so bird waste is the likely source.

NB-002 is a stormwater culvert at the beach. It was previously found to be consistent sources of elevated fecal coliform. Early in 2015 one section of the mobile home park in Allyn above NB-002 was dye tested. It was dye negative (pass). The owner of the other section did not respond to repeated attempts to contact him. A septic tank near that drainage was repaired. In Fall 2015 Washington State Department of Transportation and Mason County Public Health met on the site to discuss sediment in the catch basin. The basin is typically very clogged with sediment and slow draining. Fecal coliform does not grow in the sediment but it collects there and can remain viable for a much longer time than if it has flushed out to salt water. In that way catch basins can act as fecal coliform reservoirs. Washington State Department of Transportation is working on developing a regular schedule of catch basin cleaning. The NB-002 catch basin will be put on the schedule. It was cleaned during the site meeting (fall of 2015).

NB-003 is a stormwater culvert at the beach. During previous reporting periods it was found to be consistent sources of elevated fecal coliform. Additional recent improvements includes abandoning a septic tank near the NB-003 drainage and scheduling regular sediment removal.

NB-003 is maintained by Mason Public Utilities. Though the sediment removal occurs regularly Utilities was not sure if the filter was being changed regularly as well. This is another possible fecal coliform reservoir.

NB-002 and NB-003 could be followed up on in the future with sampling before and after culvert cleaning to see if the changes in the area have resulted in improved water quality.

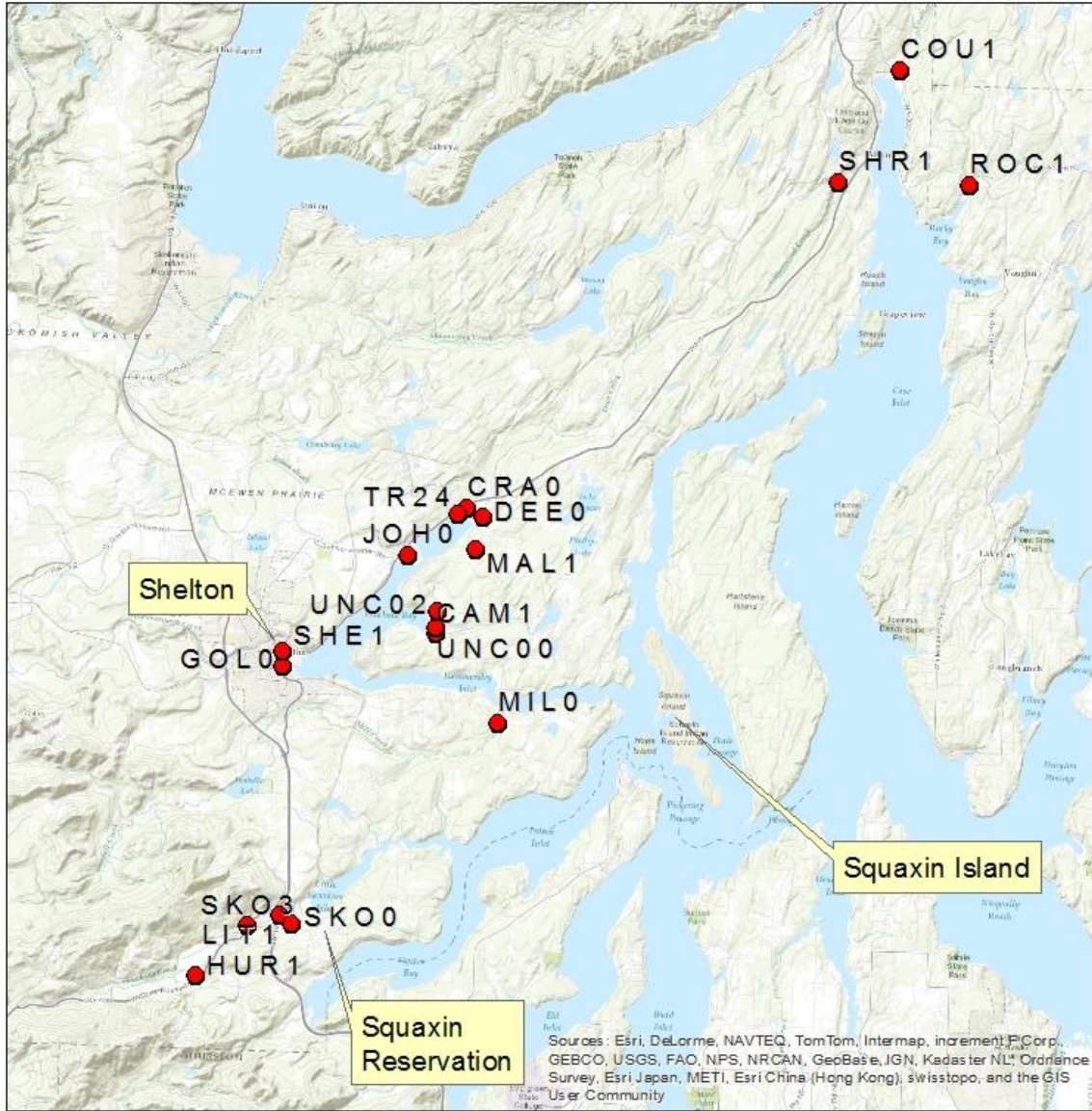
Squaxin Island Tribe Water Data

The Squaxin Island Tribe quality assurance project plan uses the marine water quality standard for freshwater samples at the mouths of streams (Table 1, Figure 22, Konovksy 2009). Note that no sites meet the marine water quality standard, but all except for TR24 meet the state freshwater standard for geometric mean in 2015. Seven sites did not meet the freshwater standard for 90th percentile in 2015. In Oakland Bay that included Site TR24 (Ecler Creek) and Uncle Johns Creek (UNC00 and UNC02) (Table 13). Much parcel investigation has been done Mason County Public Health in the past year to identify sources of bacteria, but nothing stands out as a major source in Uncle Johns in 2015. Also, Shelton Creek failed the standard for 90th percentile three out of the last four years, including 2015. Shelton Creek is urbanized. Sources of bacterial pollution in the watershed include sewage basins, human waste from homeless transient visitors, pet waste, and garbage. We are in contact with the City of Shelton to address these sources.

Skookum Creek and its tributaries (Hurley and Little) show a pattern of high bacterial counts in late summer, which causes the rolling 90th percentile to be higher than the standard (Table 13, Figure 17, Figure 18, Figure 19). We did some segmented sampling in in summer 2015 in Hurley Creek (HUR1), Little Creek (LIT1), and Skookum Creek (SKO0 and SKO3), with additional sample sites in those basins. The geometric mean and 90th percentile of bacterial concentration was generally higher in 2015 than the past years (Figure 18). This may be due to low flow and high temperatures in the stream. Sources of waste in Skookum Creek and its tributaries include livestock, septic systems, possibly elk, and a large building material dump on Little Creek. Also, near the casino, human waste from transient visitors, pet waste, and garbage affect Skookum and Little Creeks. The spatial pattern of these influences is not simple (Figure 20), but most upstream samples on Skookum and Hurley Creek do have the lowest bacterial concentrations. It is unclear why the uppermost reaches of Little Creek have higher counts than the lower reaches. This could be due to very low flow in the summer at that location.

The Squaxin Island Natural Resources Department contacted Little Creek Casino to request pet waste stations in the casino area. We also request that Mason Conservation District and Mason County Public Health do some farm outreach and septic system inventory in the Hurley Creek watershed.

Squaxin Island Tribe sampling quality control data are in Appendix III (p. 46).



Legend

- Squaxin Island Tribe

**Squaxin Island Tribe 2015
Water Quality Monitoring Stations**

Figure 17. Squaxin Island Tribe ambient sampling at the mouth of eighteen creeks. See inset details on the next page.

**Detail for Figure 17
on previous page**

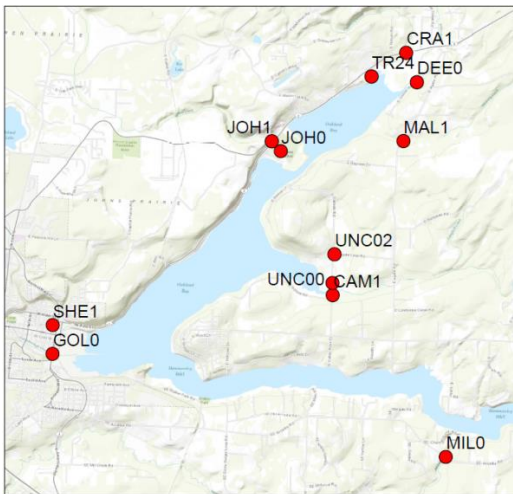
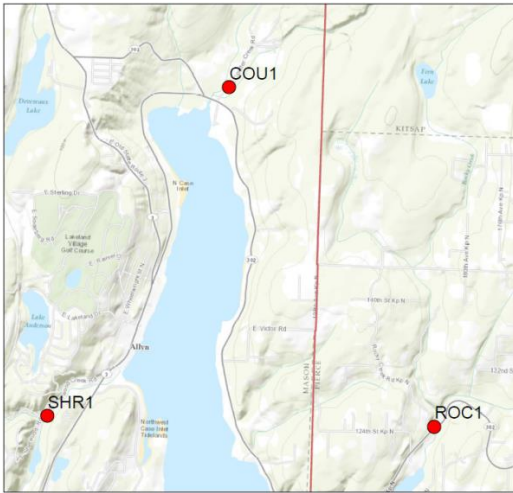
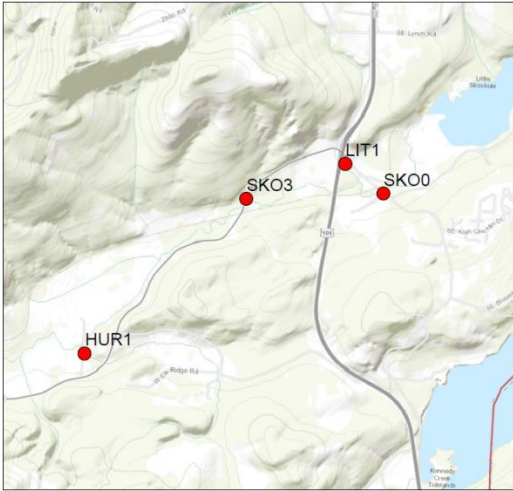


Table 13. Geometric means of fecal coliform concentration at Squaxin Island Tribe sampling sites (# of colonies per 100 ml).

Site	Geometric Mean				90th Percentile				
	2004-2012	2013	2014	2015	2004-2012	2013	2014	2015	
Campbell 1	CAM1	22	15	31	28	142	54	107	116
Coulter 1	COU1		11	17	18		55	52	89
Cranberry 0/1	CRA0/1	38	12	10	26	157	85	52	129
Deer 1	DEE0	22	21	20	26	113	102	93	95
Goldsborough 0	GOL0	27	29	26	25	120	100	88	101
Hurley 1	HUR1	46	12	20	63	279	72	155	222
Johns 0/1	JOH 0/1	14	9	15	23	59	31	44	70
Little 1	LIT1	32	10	22	52	185	94	125	317
Malaney 1	MAL1	28	17	21	26	172	131	128	101
Mill 0	MIL0	17	12	32	32	70	25	152	72
Rocky 1	ROC1		21	18	36		214	58	71
Shelton 1	SHE1	71	63	53	88	449	340	140	235
Sherwood 1	SHR1		16	18	29		59	39	64
Skookum 0	SKO0	45	26	41	72	275	56	156	165
Skookum 3	SKO3	45	28	36	53	231	108	89	104
TR24	TR24	69	25	28	116	1012	261	372	854
Uncle Johns 0	UNC00	55	21	42	82	324	72	181	450
Uncle Johns 2	UNC02		17	36	76		65	125	299

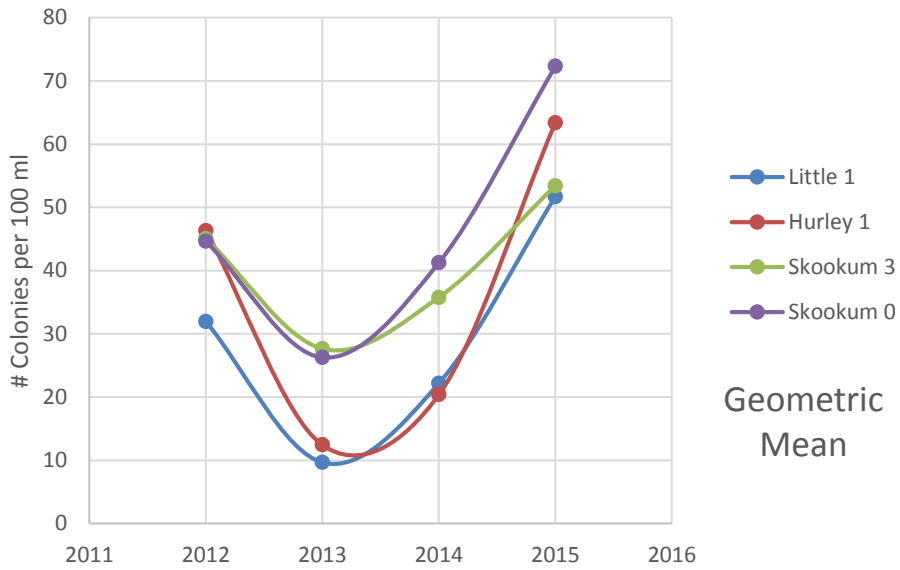


Figure 18. Annual geometric mean of fecal coliform bacteria concentration in Skookum Creek and its tributaries, 2012-2015.

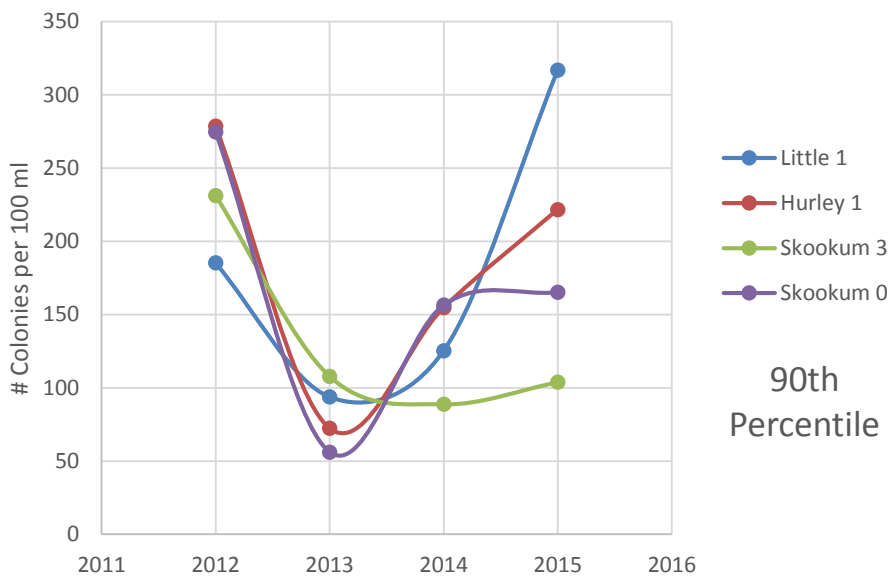


Figure 19. Annual 90th percentile of fecal coliform bacteria concentration in Skookum Creek and its tributaries, 2012-2015.

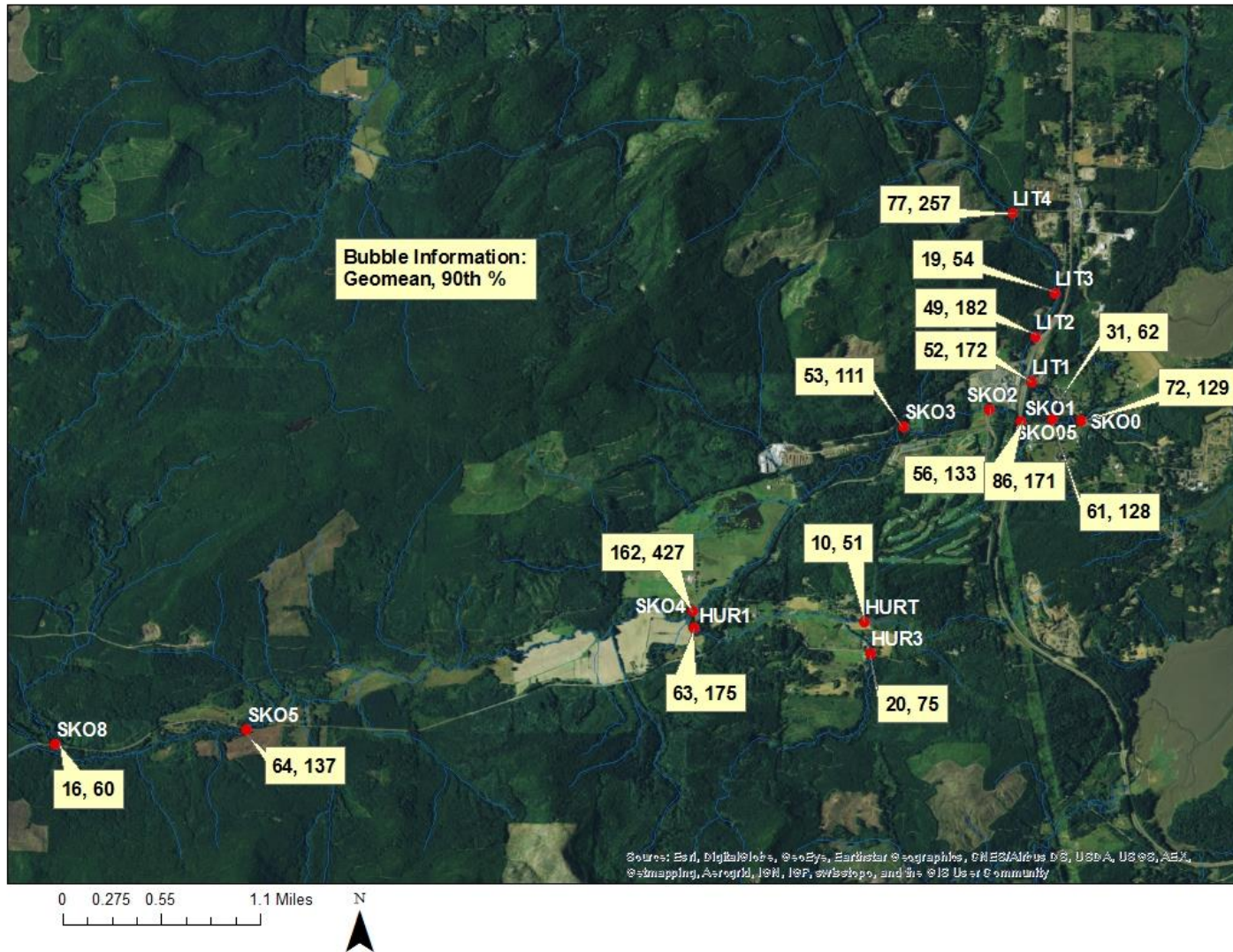


Figure 20. Geometric mean and 90th percentile of fecal coliform bacterial concentration (# of colonies per 100 ml) in Skookum Creek and its tributaries in 2015. Samples taken by the Squaxin Island Tribe.

Mason County On-Site Septic Program

Overall Activity

There are currently 26,122 septic systems in the county. We do not have records for 3,755 systems, but we know the systems exist due to the presence of a household structure on the property and pumping or maintenance. We had records for 83.61% of our systems in 2014 and 85.58% in 2015. We have some grant monies to allow us to do after-the-fact record drawings for the remaining systems.

- Mason County Health Department issued 322 septic system permits for 2015. Of those permits, 121 were repairs, and the rest were for new systems (Figure 21)
- Of the 121 repair permits, 75 were in the study area with 13 of those on the shoreline, 44 in Hood Canal with 20 on the shoreline.
- The 121 repairs were from 6 complaints, 68 maintenance reports and 47 homeowners voluntarily having their system repaired or upgraded.
- Septic system records are available online.
- County homeowners had a total of 4,161,912 gallons of septic waste pumped in 2015. That is a 19.9% increase from the year before.

Figure 22 is a map of Oakland Bay that shows which parcels with known onsite septic systems are in compliance or not in compliance with Mason County's required onsite septic maintenance schedules.

Education and Outreach

Participated in workshops with WSU on 5/21/2015 at the Harstine Community Hall, approximately 25 attendees, 6/4/2015 at Mason Benson Club House, approximately 20 attendees. We manned an operation and maintenance booth at the Taylor Shellfish Seed Sale on 5/16/2015 and 6/27/2016. We manned an operation and maintenance booth at the Oakland Bay Days on 6/6/2015. We had the Septic Blitz from 6/15/2015 thro 6/29/2015. Signs were hung across the highway on two entrances into Shelton, one on a bulletin board at the Firehall in Tahuya, one across the highway going to Lake Cushman, one on the road side at Deer Creek, one at the entrance into Belfair and two hanging from the bridge at Blue Heron Condos on 106. Sent out 20,563 every-door-direct-mailing postcards county wide for the Septic Blitz held 6/15/2015 thro 6/29/2015. It was publicized on our Mason County news and Mason County Transit. We also had a presentation on KMAS radio station where we were interviewed about the purpose of the blitz. We had our blitz awareness at this time of the year due to the large percentage of on-site septic owners that only visit their homes in the summer months. Sent out 10,578 every-door-direct-mailing postcards to Oakland Bay, Case and Totten Little Skookum watershed reminding them it was time for maintenance. On another grant we sent approximately 6,200 reminders to property owners that we do not have records of maintenance since we started our O&M database in 2004. We received phone calls and e-mails from 15 to 20% of the letters sent out. Our findings were the recipients had had maintenance but it was not reported by the provider, were on a sewer system or the properties were not developed. The largest number of contacts wanted information concerning their on-site system. We sent out packets with their records and O&M information. Mason County Public Health participated in the SepticSmart Week in September. Washington State University Extension and Mason County Public Health presented three on-site septic operation and maintenance classes in Tahuya, Shelton and Grapeview.

Mason County Public Health staffed an educational booth at Oysterfest, October 3 and 4 from 10:00AM to 6:00PM. We distributed educational materials on all aspects of on-site and answered questions from the public. There were 12,000 visitors at the event.

Rebates

In 2015 we extended the rebate program to Oakland Bay, Totten Little Skookum and Case watershed. We had a total of 306 rebates. Rebates were for risers and or effluent filters and pumping or maintenance. People could qualify for a total of \$400.00 rebate per septic system. Total of \$61,588.74 was given out for rebates

Complaints and Failures

The county followed up on 72 sewage complaints for 2015. Forty-four of those complaints were within this grant area. If a complaint or any other inspection results in necessary repairs to the system, and the owner does not comply, the county will post the site for non-occupancy. This happened once this year. Of the 44 complaints, 24 were resolved, 11 were invalid and we are still working on the other 9.

Upcoming Plans

Mason County Public Health plans to do a septic system operations and maintenance blitz in the last two weeks of June 2016. We will be using the banners from the 2015 blitz and the new City of Shelton reader boards. We will also use the newspaper and radio to advertise the blitz with an every-door-direct-mailing postcards to all of Mason County residences. After that, we will be ready to field inquiries and to use the remainder of their rebate funding as incentive for repairs and maintenance.

We will have an operation and maintenance booth for two of the Taylor Seed Sales, be present at the Oakland Bay Days and 2016 Oysterfest.

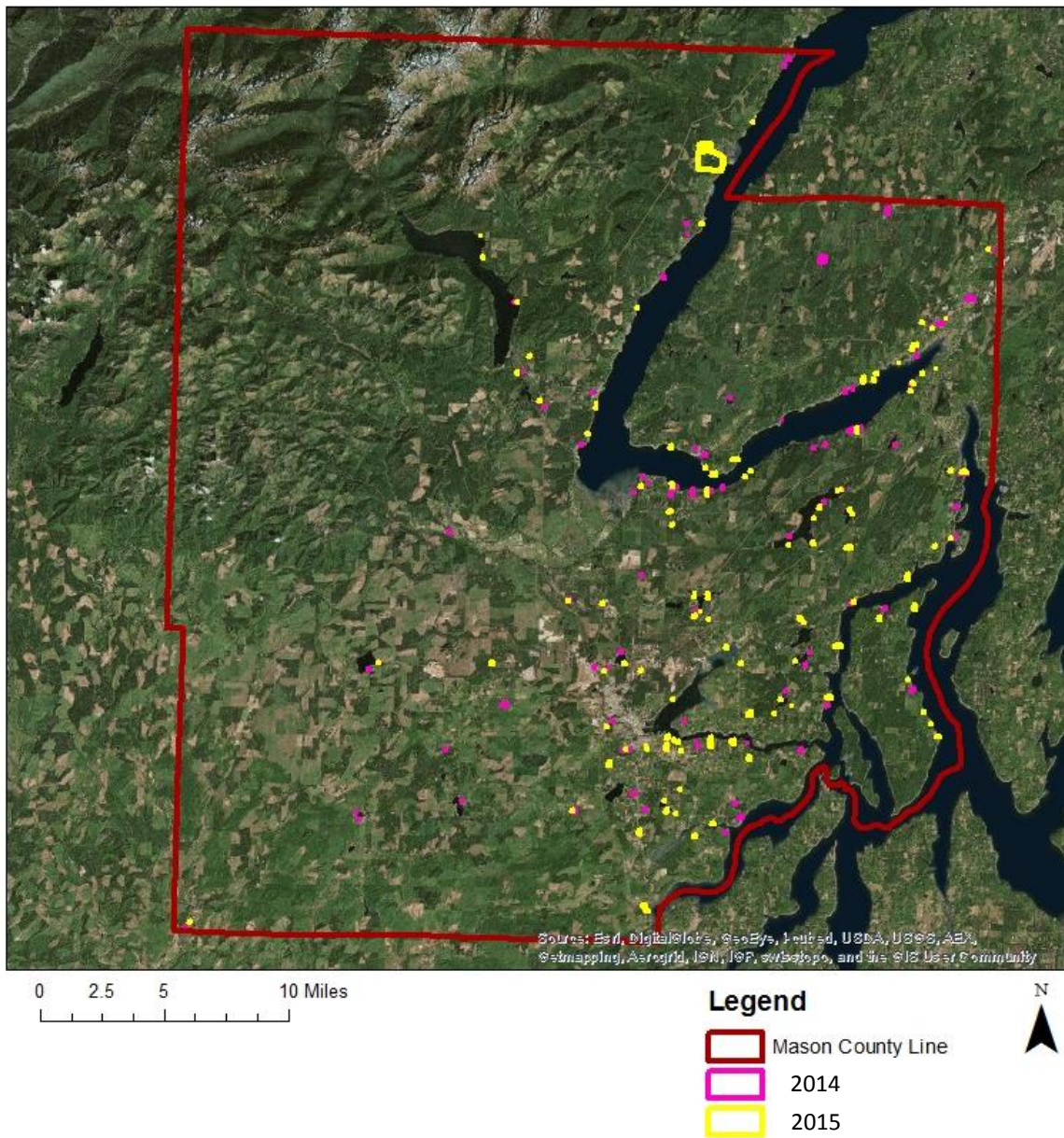


Figure 21. Mason County total septic system *repairs* in 2014 and 2015. There were 88 repairs in 2014 and 121 repairs in 2015. There were also 182 new septic systems installed in 2014 and 201 new septic systems installed in 2015.

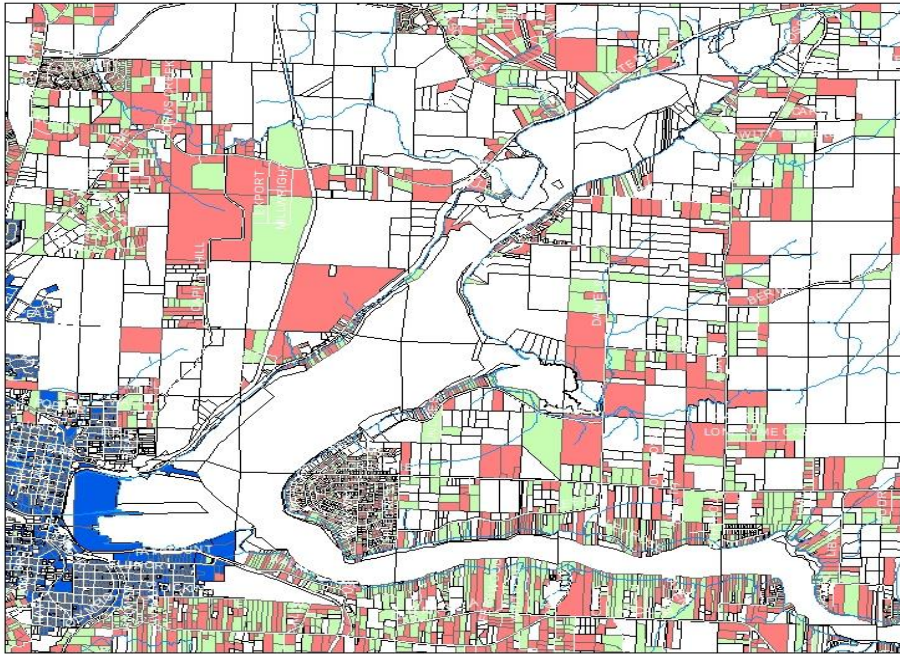


Figure 22. Properties with Onsite Septic Systems (OSS). Properties highlighted green are in compliance with Mason County’s maintenance schedule. Properties highlighted in red are not compliance with Mason County’s maintenance schedule. Source data is the Carmody Operations and Maintenance Database, with updates submitted to WA Dept. of Health every 6 months.

Washington State University Extension Activities



Mason NEP PIC Program Outreach 2015

Washington State University Mason County Extension conducted a variety of outreach activities throughout 2015 to highlight water quality issues and the ongoing efforts made to address them. A summary of these outreach activities is listed below.

- Shore Stewards Program
 - The Shore Stewards program currently has over 600 member households in Mason County. Shore Stewards are provided information on best management practices for shoreline properties and receive a regular newsletter with highlights, updates, educational opportunities, and offers of technical assistance. In 2015, the newsletters featured information on using rain barrel water, designing with nature, an introduction to streams, and creosote along the shoreline. The Shore Stewards materials were also updated in 2015 including a new website (shorestewards.wsu.edu), an updated “Guide for Shoreline Living”, and a Shoreline Living DVD.
- Water quality report card and updates
 - An Oakland Bay water quality update was produced and made available to local residents. The report highlights water quality sampling results, areas of concern, and best management practices on topics including pet and livestock waste, septic system maintenance, and stormwater management for use on local properties.
- Taylor Shellfish Seed Sales, Taylor Shellfish Farms
 - May 16, June 27, August 29
 - Direct outreach to shoreline property owners on water quality issues, best management practices, and the Shore Stewards program.
- Oakland Bay, Bayshore Preserve, June 6
 - Approximately 200 people attended this family friendly event coordinated by WSU and the Mason ECO Net. The event featured educational exhibits and activities, a site tour and discussion of restoration activities, live music, shellfish snacks, and a scavenger hunt for children. The WSU booth had information on water quality issues, best management practices, and the Shore Stewards program.
- Septic Sense Workshops
 - May 21, June 4, August 25, September 15, September 22
 - In Shelton, Harstine Island, Grapeview, and Tahuya.
 - Workshops were held in partnership with Mason County Public Health. Provided information to residents with onsite septic systems on the best management practices to maintain them, use them properly, understand how they function, and know when they need to be repaired.
- OysterFest, Mason Fair Grounds, October 3-5
 - Direct outreach to shoreline property owners on October 4-5 on water quality issues, best management practices, and the Shore Stewards program.
 - Kids Day at OysterFest education programs for local 4th grade classes on October 3.

Mason Conservation District Activities

Mason Conservation District continues to actively work within the framework of the Mason County Pollution Inventory and Correction (PIC) program for mitigating water quality and fish habitat concerns in Mason County. Through the PIC Advisory Committee, district efforts have been primarily focused within the Oakland Bay Watershed. Mason Conservation District staff working on these efforts include; Small Farm Specialists, Natural Resource Planners, Engineering Staff, Environmental Specialists, and the District Manager. Activities include: technical assistance with individual parcel owners, farmland inventory development, priority ranking criteria, farm plan preparation, and implementation of identified best management practices.

MCD staff are currently working with 16 landowners whose operations directly impact the Oakland Bay Watershed (including Chapman Cove). A total of 103 BMP's were identified in all of Mason County at the outset of this grant. Figure 23 shows where a variety of funding has been secured to do BMP's and where landowners are currently implementing BMP's. Funding for these BMP's has been secured, or is being solicited from the PIC program, the WSCC Shellfish program, FSA CREP program, RCO Riparian Enhancement program, and NRCS. These BMP's will specifically address agricultural water quality impacts and enhancement of riparian habitat/buffers along riparian and agricultural drainage systems. However, only three BMP's were implemented and funded through PIC Ag funds in the 2014-2015 biennium. This occurred because the landowners chose not to implement 35-ft buffers on agricultural ditches, which was required for PIC funds.

MCD has continued efforts in collaborating with area agricultural producers that have been identified either through marine water quality assessment (DOH) or through the development of the farm inventory ranking criteria for drainage system focus. The farm inventory ranks drainages within the county based on livestock access and proximity to surface water, windshield surveys of livestock populations, and current site conditions/infrastructure, etc. A ranking criteria has been developed to inform of "Very High" to "Low" prioritization of drainage systems to help guide a multi-scale approach to outreach and mitigation efforts in the county.

In addition to the landowners identified in the Oakland Bay Watershed, MCD has also identified additional high priority landowners in watershed impacting Puget Sound and Hood Canal. Additional PIC funding will likely be needed in areas outside of the immediate Oakland Bay Watershed. MCD is providing technical assistance to a number of new landowners who will need financial assistance to implement needed BMP's for water quality and riparian buffer enhancement on agricultural lands in Little Skookum Inlet, Pickering Passage, North Bay, Annas Bay and Lynch Cove.

Mason Conservation District has revitalized the manure exchange program. PIC Ag funding was used to fund a trailer rental reimbursement program that allowed participants to remove manure from sites with excess to their properties where the manure could be composted and safely used as a soil amendment. In addition, a WSDA grant was obtained to provide safe manure composting and application education for manure exchange participants.

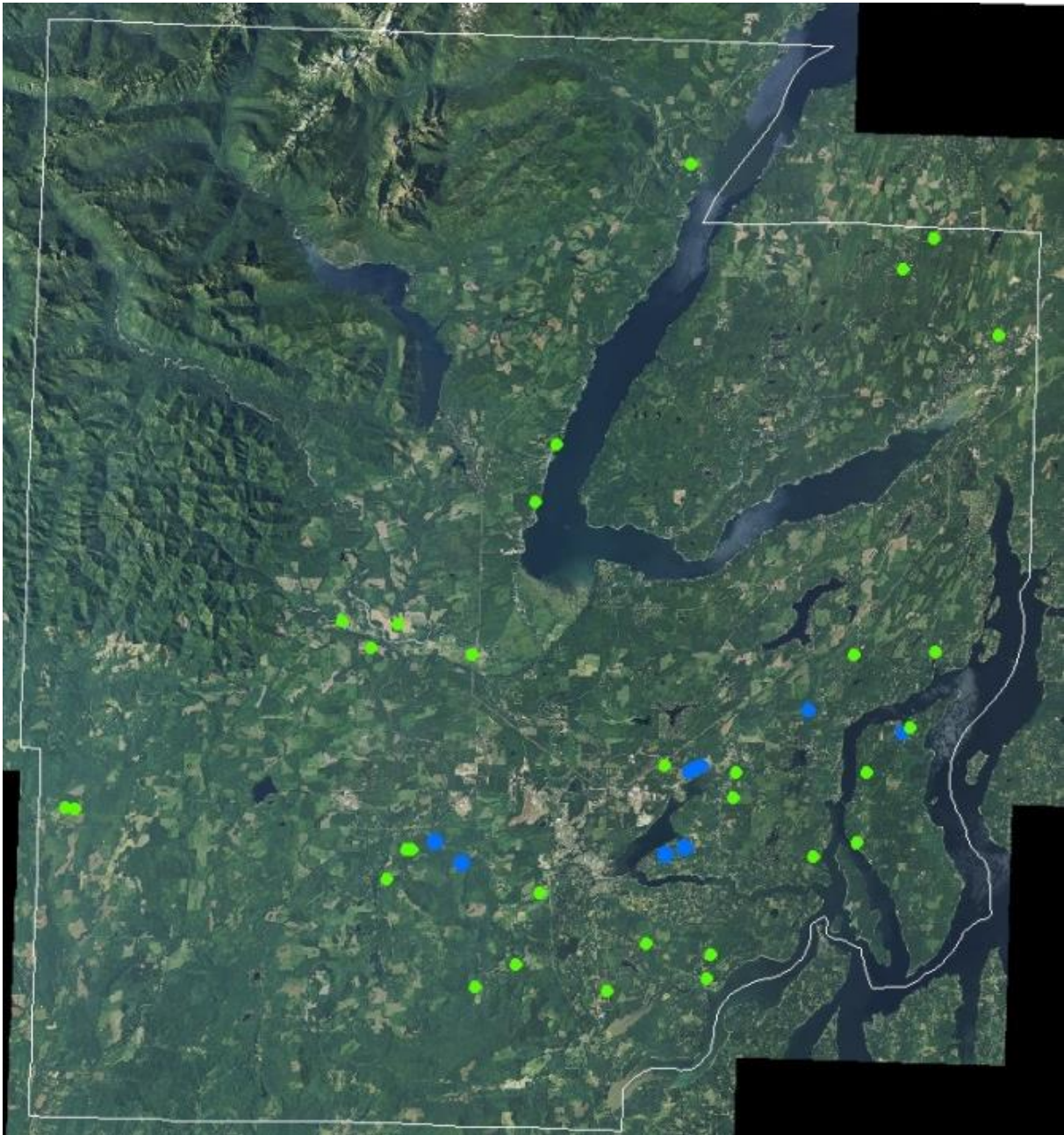


Figure 23. Mason Conservation District secured PIC Ag funding for the landowners represented by the blue dots. Green dots represent some of the landowners currently implementing BMP's with assistance from Mason Conservation District.

References

Kenny, Stephanie. March 2012. 2011 annual report on the activities of Mason County Public Health and Human Services in Oakland Bay

Konovsky, John. August 2009. Squaxin Island Tribe shellfish early warning system quality assurance project plan.

Oakland Bay MRA QApp 2008. Mason County Oakland Bay Onsite Septic System Marine Recovery Area Project, Quality Assurance Project Plan, Written by Mason County Public Health.

PIC Flowchart, 2014- Guidance for Water Quality Compliance in Mason County, Written by Stephanie Kenny (Mason County Public Health) and Erica Marbet (Squaxin Island Tribe) in discussion with Erik Hagan (WA Dept. of Ecology) and Derek Rocket (WA Dept. of Ecology).

PIC Protocol, 2014- Guidance for Farm Management Referrals, based on discussions between Erik Hagan (Mason Conservation District), Stephanie Kenny (Mason County Public Health), Derek Rocket (WA Dept. of Ecology), and Erica Marbet (Squaxin Island Tribe).

Oakland Bay MRA QApp 2008. Mason County Oakland Bay Onsite Septic System Marine Recovery Area Project, Quality Assurance Project Plan, Written by Mason County Public Health.

Appendix I. Quality Control Data of Mason County

DATE	DUPLICATES	BLANKS
2/17/16	1	0
2/18/16	1	0
2/23 & 24	1	1
3/4/16	1	1
3/9/16	1	0
3/10/16	1	1
3/18 & 19	1	0
4/1/16	1	0
4/15 & 16	1	0
5/4/16	1	1
5/5/16	1	0
5/18/16	1	1
5/19/16	0	0
5/27/16	1	1
6/1/16	1	1
6/2/16	1	0
6/15/16	1	0
6/16/16	1	1
6/17/16	0	0
6/29/16	1	1
6/30/16	1	1
7/14/16	0	0
7/21/16	1	0
7/22/16	1	1
7/27/16	1	1
7/28/16	1	1
8/10/16	0	1
8/11/16	1	1
8/24/16	0	0
8/25/16	0	1
8/26/16	0	1
8/31/16	0	1
9/8/16	0	1
9/10/16	1	0
9/14/16	1	1
9/21/16	1	2
09/22/16	0	2

DATE	DUPLICATES	BLANKS
10/5/16	1	1
10/6/16	1	1
10/7/16	1	1
10/21/16	1	1
10/27/16	1	1
10/28/16	1	1
11/2/16	2	1
11/3/16	1	1
11/4/16	0	1
11/9/16	1	1
11/17/16	1	1
11/18/16	1	1
11/19/16	1	2
11/23/16	0	0
11/30/16	0	1
12/1/16	1	1
12/7/16	1	1
12/18/16	2	0

TOTAL 2015	
SAMPLING DAYS	55
DUPLICATES	44
BLANKS	41

Appendix II. Ambient Data collected by Mason County

Tier I Ambient Results. Fecal coliform bacteria (# of colonies per 100 ml)

Precip. (inches)	0	0.01-0.25	0	0	0	0	0	0	0	1.0-2.0	Geometric Mean (excluding rain events)
Site	2/18/2015	4/15/2015	4/16/2015	6/2/2015	7/14/2015	8/11/2015	9/21/2015	10/21/2015	10/28/2015	12/8/2015	
19	15	84		52	120	40	59	51	80	43	54.311
DER1		9		49	23	56	120		320	200	52.858
LYN1	3	17		49	49	71	24		4	52	18.815
NB-022			1	57	580	100	9.5	2	60	87	23.336
NB-023			20	106	520				75	95	95.356
PBW1	9	3		14	31	26	15	13	4	47	11.143
PP-001	4	7		110	160	36	30	16	44	44	27.971
PP-003	4	17		200	100	50.5	16	8	28	95	26.54
RAU1	100	15								130	38.73
TL-001	1	1		14			36	21	35	29	8.4746

Appendix III. Quality Control of Squaxin Island Tribe Fecal Coliform Sampling

A single blank and as single duplicate were taken on each day of sampling, occurring once a month. Samples were processed at WA Dept. of Ecology's Manchester Lab. The large relative percent difference is due to the variability of fecal coliform bacteria distribution in streams.

Sample Date	Location	Sample # Col/100ml	Duplicate # Col/100ml	Relative % Diff
1/20/2015	No duplicate			
2/17/2015	SHE1	17	17	0%
3/18/2015	LIT1	460	330	33%
4/28/2015	COU1	0	2	-200%
5/27/2015	SHR1	47	57	-19%
6/30/2015	SHR1	26	37	-35%
7/29/2015	CRA0	120	210	-55%
8/11/2015	GOLS3	36	32	12%
8/26/2015	SHE1	170	180	-6%
9/9/2015	GOL0	39	26	40%
9/15/2015	LIT2	29	28	4%
10/13/2015	GOLS3	6	10	-50%
10/27/2015	DEE0	59	97	-49%
11/9/2015	HUR1	100	120	-18%
12/9/2015	UNC02	130	110	17%